North Dakota Forest Service

North Dakota Forest Health Highlights 2014

NDSU

North Dakota Forest Service,
North Dakota State University

Overview

This report summarizes forest health highlights observed in North Dakota during 2014.

Weather trends of significance, forest pest and health surveys are summarized, and specific forest insects, diseases and damaging abiotic agents of current concern are described.

The information presented in this report was compiled from various sources and methods, including site visits, on-the-ground forest health surveys, aerial surveys and personal communication with natural resource professionals.

An additional purpose of this report is to provide an overview of the most notable emerging forest health issues in relation to their effects on the sustainability and societal value of North Dakota's tree and forest resources.

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Cover Photos: A. Bergdahl, North Dakota Forest Service.

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Weather-Related Trends

Due to an unusually fast warmup following a longer than usual and harsh 2014 winter, severe conifer winterburn was reported across the state. Additionally, with temperatures staying unusually cool into June 2014, leaf disease development was delayed. With June also being the wettest month of the growing season (Figure 1, top right) and the 16th wettest in 120 years, conditions perpetuated several leaf diseases in 2014 that were prevalent in 2013 (Akuz et al. 2014).

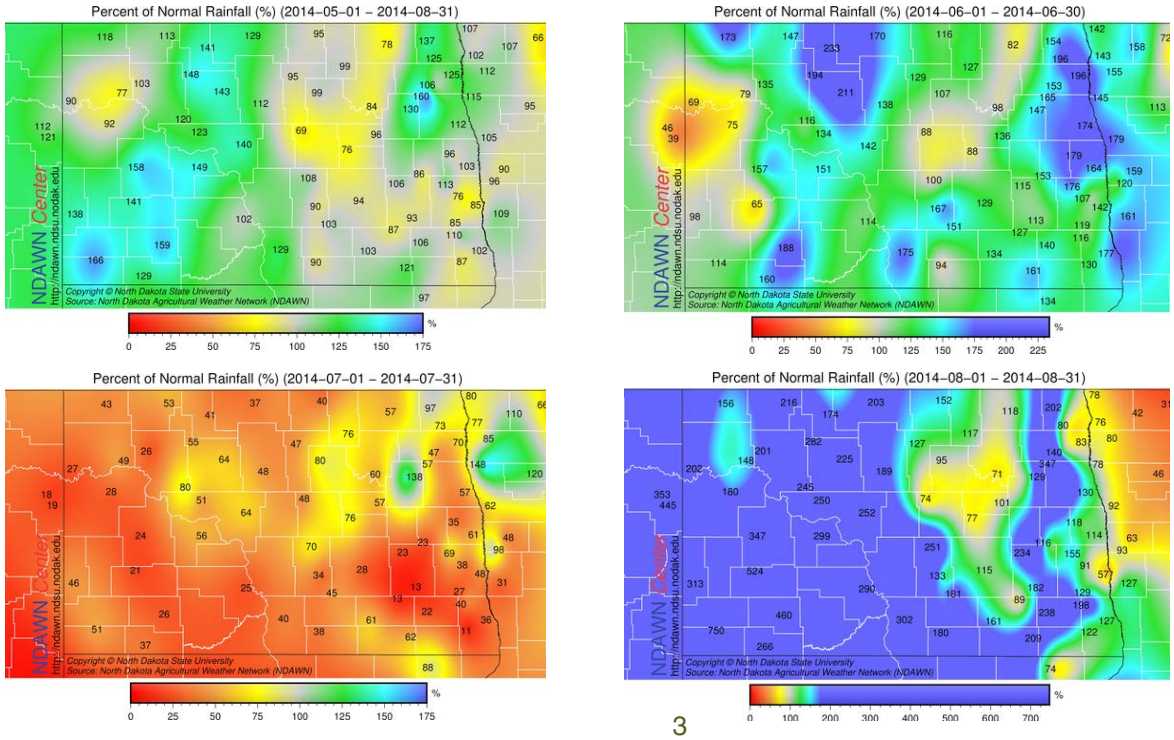
In viewing Figure 1 (top left), the 2014 growing season appears wetter than normal, and this is true overall, but it does not characterize well the month-to-month fluctuation of conditions. For example, Figure 1 (bottom left) depicts the percent of normal rainfall for July, with levels falling to roughly 50 percent of the norm across most of the state. In fact, July was rated as the 19th driest in the past 120 years (Akuz et al. 2014).

Thus, the leaf diseases characterized by cyclical infection that benefitted from a wetter June were halted in July when dry condition prevailed.

Drought stress to trees was reported from several areas in the state after July. What followed was an extremely wet August (fourth wettest in 120 years; as a specific example, 795 percent of normal rainfall in the southwestern part of the state, Figure 1, bottom right) and a very dry September across most of the eastern part of the state (below half normal precipitation in many areas).

In summary, many diseases developed due to wet weather in 2013 but never gained significant momentum due to the wet/dry pattern of 2014. These highly fluctuating weather statistics typified conditions during the 2014 growing season.

Figure 1: (top) Percent of normal rainfall for the 2014 growing season; (second) percent of normal precipitation for June 2014; (third) percent of normal rainfall for a very dry July; (bottom) percent of normal rainfall for August 2014. (*North Dakota Agricultural Weather Network*)



Section II

Invasive Insect Detection and Forest Health Surveys

Cooperative Tree Pest Monitoring Trapping: Gypsy Moth

In 2014, the North Dakota Forest Service (NDFS) Forest Health Program again cooperated with the North Dakota Department of Agriculture (NDDA) and U.S. Department of Agriculture Animal and Plant Health Inspection Service Plant Protection and Quarantine (APHIS PPQ) and placed 147 of a total of 339 traps (Figure 2).

No gypsy moths were detected in 2014. This is very positive because the NDDA initiated trace-forward monitoring activities due to a potential introduction of nursery stock infested with Gypsy moth.

The 2014 trapping was conducted solely by forest health interns. No positive finds of gypsy moth have occurred in North Dakota since 2005 (Mike Kangas, personal contact).

Figure 2: A gypsy moth trap. (*Aaron Bergdahl, NDFS*)

Cooperative Tree Pest Monitoring Trapping: Emerald Ash Borer

In 2014, NDFS Forest Health placed roughly 80 Emerald ash borer (EAB) monitoring traps in cooperation with the NDDA and APHIS. No EAB were detected in 2014. EAB trapping was conducted solely by forest health interns in 2014.

Figure 3: An emerald ash borer trap. (*Aaron Bergdahl, NDFS*)

Section III

General Insect, Disease, Abiotic and Undetermined Trends of Significance in North Dakota, 2014

Japanese Beetle (*Popillia japonica*)

In 2014, following a record-cold winter, Japanese beetle was trapped in a total of 13 locations in the following areas: Fargo, Bismarck and one location in Grand Forks (Figure 4). Six trap locations were in parks that were not near tree nurseries. This is significant, because the suspected source of the introduction of Japanese beetle was infested nursery stock from an out-of-state supplier. The pest has not been verified to be established in North Dakota, but this information is certainly an indication that the pest can overwinter here.

Japanese beetle is of concern to tree health due to its strong feeding preference for the foliage of American basswood (*Tilia americana*) and little-leaf linden (*Tilia cordata*). It also is a serious pest of many woody horticultural plants and is able to feed on more than 300 different species.

Figure 4: Japanese beetle adults found in 2014 NDDA monitoring traps. (*Aaron Bergdahl, NDFS*)

Zimmerman Pine Moth (*Dioryctria zimmermani)*

Cooperative efforts to manage Zimmerman pine moth at Icelandic State Park will continue in 2015. NDFS Forest Health has been partnering with the North Dakota Parks and Recreation Department to develop effective management strategies to reduce damage from Zimmerman pine moth in plantings in high-use areas of the park (Figure 5). Last year's effort to use a granular systemic insecticide were reviewed in 2014 and a new approach will be taken in 2015.

Zimmerman pine moth is a very challenging pest to manage in the northern Plains and little current information has been published on this topic. Ideas for control strategies have been communicated by members of the forest health community in the Plains.

Figure 5: Pitch masses at branch whorls (top) are typical symptoms of Zimmerman pine moth infestation that can lead to stem breakage, especially in smaller-diameter trees (bottom). (*Aaron Bergdahl, NDFS*)

Ponderosa Pine Windbreaks Decline in Burleigh, Kidder and Stutsman Counties

The decline of mature ponderosa pine windbreaks has been seen increasingly in the past years in Burleigh, Kidder and Stutsman counties. Decline, such as that pictured in Figure 6, has been reported to be quite rapid and has been associated with damage that appears to be of a "wilting" type. No signs of root pathogens were discovered following digging around the base of several trees, and soil test results have been within normal ranges.

Figure 6: A mature ponderosa pine windbreak in Burleigh County, N.D., showing rapid decline in July 2013. Most of these trees died and have since been removed (*Aaron Bergdahl, NDFS*).

Closer observation of these conservation plantings revealed the presence of ips engraver beetles that seem to have taken advantage of stressed trees. In many cases, the trees were planted to meet past cost share specifications or in line with the recommendations of that time, which meant they were placed too close together for the long-term health of the trees.

Today, in situations where shelterbelts and plantings have not been thinned, the mature trees are in heavy competition with neighboring trees for resources. Additionally, trees may be affected by other stressors such as herbicide exposure and competition with heavy bromegrass and other vegetation. These factors together clearly represent significant stressors leading to tree decline and making them attractive and susceptible to mass attack by ips beetles.

A similar, large-scale example of this was observed at the North Beulah Mine Wildlife Management Area in Mercer County, where most pines in that area were suffering dieback and mortality due to heavy ips infestation throughout the area. (Figure 7)

Figure 7: (top) Symptoms of ips infestation at North Beulah Mine Wildlife Management Area in Mercer County, N.D.; (bottom) insect galleries, larvae, pupae and adult ips beetles were evidence of ips infestation at North Beulah Mines. A blue-stain fungus associated with bark beetles can be seen on the cross-section of wood in the image on the right (*Aaron Bergdahl, NDFS*).

Apple Diseases

Figure 8: Fire blight of crabapple in Valley City, N.D. (*Aaron Bergdahl, NDFS*)

Figure 9: Black rot canker in Cass County, N.D. (*Aaron Bergdahl, NDFS*)

Fire blight (*Erwinia amylovora*) (Figure 8) continues to be a commonly encountered problem on apple trees, caragana and pear trees in North Dakota. This was especially true in 2014 in areas experiencing higher than normal precipitation.

The same was true for other common diseases of apple, such as black rot (*Botryosphaeria obtusa*) (Figure 9) and apple scab (*Venturia inaequalis*) (Figure 10). They remained significant in areas receiving normal to above-normal precipitation while disease occurrence was notably lower in the driest areas of the state. Foresters suspect that the level of these diseases still was encountered in the driest regions due to homeowner irrigation practices.

Homeowners who do not take measures to avoid spraying water directly on the crown of trees and unintentionally prolong periods of leaf wetness unknowingly create favorable conditions for the development of these diseases. Efforts continue to encourage homeowners to irrigate at night and avoid spraying irrigation water directly on tree foliage.

Figure 10: Heavy summer defoliation due to severe apple scab infection in Pembina County, N.D. (*Aaron Bergdahl, NDFS*)

Cottonwood Canker Fungi

Cankers of cottonwood were recognized as a significant problem throughout North Dakota in 2014 with several calls for assistance in towns as well as in shelterbelt plantings (Figure 11). The canker fungi involved were thought to be Phomopsis canker of cottonwood (*Phomopsis macrospora*) and a *Cytospora* spp., based on observations.

In several cases, the most severe cankering was seen on cottonless hybrids of cottonwood. In most cases, these trees were at the end of their service life or otherwise were stressed for unclear reasons.

No effective management strategies are available for these cankers. Foresters have observed that in our region, hybrids of the genus *Populus* typically accrue tree health issues after about 25 years of growth and steadily decline thereafter. This should be considered when using these hybrids as shelterbelt and landscape plantings.

Figure 11: Cankers on cottonwood in shelterbelts in Cavalier and Cass counties in North Dakota. (*Aaron Bergdahl, NDFS*)

Spruce Needle Diseases

Stigmina needle cast appears to have replaced Rhizosphaera needle cast throughout North Dakota, but many people are not aware of any change because the symptoms of both diseases are quite similar (Figure 12). Management recommendations for Rhizosphaera are not adequate for Stigmina management, but until the actual extent of the two pathogens is determined, recommendations for both diseases need to be provided.

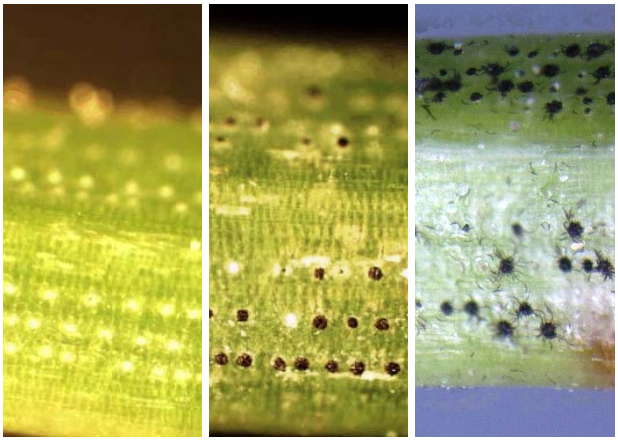


Figure 12: (left) A healthy needle; (middle) a needle with characteristically smooth-margined Rhizosphaera fruiting bodies; (right) a needle with the fuzzy-appearing tendriled fruiting bodies of Stigmina needle cast fungus. (*Kasia Kinzer, NDSU*)

Spruce Phytoplasma

Several reports of deformed spruce needles, as pictured in Figure 13, have emerged in isolated areas of North Dakota. In these cases, the use of herbicides in the area has been eliminated and questions have been raised about possible agents.

Figure 13: Deformed new growth of spruce due to infection by a phytoplasma has been reported in several locations in North Dakota (*Aaron Bergdahl, NDFS*).

Molecular analysis was used at NDSU Plant Sciences Department to verify the possible presence of a phytoplasma,'*Candidatus* Phytoplasma *pini*,' that may be responsible for this type of deformation. Although results were inconclusive for the sample pictured in Figure 20, as well as a few others, a sample from western N.D. tested positive. This is not currently a major threat to general spruce health; however, it has been seen to spread in conservation plantings and stunts tree growth, and thus could reduce windbreak effectiveness. If this type of deformation is not the result of a phytoplasma, researchers have suggested that the agent of damage may be some kind of eriophyid mite.

Winterburn

The number of reports of winterburn of conifers was typical for 2013, while the prolonged, harsh winter of 2014 resulted in a major spike in reports. In urban settings, conifers with winterburn symptoms were so abundant, they just about outnumbered those without symptoms.

Rural plantings also were injured at higher-than-normal levels (Figure 14). This phenomenon was not so much a factor of poor soil moisture conditions going into the fall of 2013 or the very cold, harsh winter; instead, it was a consequence of a rather fast warmup period following a delayed spring.

Figure 14: Winterburn to (above) black hills spruce and (left) yew. (*Aaron Bergdahl, NDFS*)

Porcupine Feeding Damage

Porcupine damage was seen commonly throughout the native ponderosa pine stands of Slope County, N.D. (Figure 15). From the 2014 aerial survey of this unique resource, flagging of branches and areas of overall general health decline were recorded by aerial surveyors.

Concerns about the possibility of pine engraver beetle outbreaks (*Ips* spp.) were mentioned as a possibile cause of the damage seen from the air. This was a major concern because fuels-reduction activities had been conducted in the area for several years and slash piles in the area had not been removed.

Luckily, ground-truthing efforts showed that, although engraver beetles had used the slash piles as brood wood for reproduction, their numbers had not reached high levels, and evidence of engraver beetle attack was seen only in a few select areas that previously had been stressed by wildfire and heavy porcupine feeding.

The greater problem seen from the ground was extensive damage from porcupine feeding. The areas of damage ranged from the tops of trees to major branches and the main stem. Damaged and, therefore, stressed trees such as those seen throughout the area are, in turn, very attractive to engraver beetles for breeding and feeding. Steps have been taken, in cooperation with land managers, to address the management of slash piles and continue to monitor tree insect and pest conditions.

Figure 15: Examples of porcupine feeding damage on ponderosa pine in Slope County, N.D. (*Aaron Bergdahl, NDFS*).

Cultural Practices

Herbicide (Figure 16) continues to be a commonly encountered abiotic agent of damage to trees and shrubs in urban and rural environments. Improper or careless selection and/or application of pesticides constitutes a substantial percentage of homeowner inquiries regarding tree and shrub health in North Dakota.

Cultural practices, such as improper planting, mulching, pruning, watering, fertilization practices and failure to remove landscape fabric, mostly by private homeowners, constitute a major proportion of tree health issues responded to by the Forest Health Program in North Dakota. Continued efforts to educate the public about species and site selection (right tree for the right place) and proper tree care continues to be a priority of the North Dakota Forest Service, North Dakota State University, and state and municipal entities involved in the care of tree resources.

Figure 16: Herbicide damage to hackberry in Bottineau, N.D. (*Aaron Bergdahl, NDFS*)

Section IV
Forest Health Surveys 2014

In recent years, forestry departments across the state have been seeing an increase in damage to newer plantings of oak trees. The symptoms are shredding of bark leading to desiccation and deformation/mortality (Figure 17).

The significance of the problem was brought to the attention of the NDFS by the city forester in Fargo. In cooperation with NDSU Extension, the NDFS began efforts to better understand this phenomenon in the winter of 2014. Branches were examined closely, and samples were taken and brought inside in plastic totes to see if any insects would emerge.

Shortly after being brought inside, hundreds of tiny unidentified wasps began to emerge. Samples of the wasp were submitted for identification. However the identification of tiny wasps such as those emerging from the branch samples is often very difficult and expertise in this particular area is lacking. By examining the branches more closely it became clear that something was foraging for the wasp larvae in the bark causing the shredding symptom. Later, reports of downy woodpeckers foraging on oak trees caused the damage which allowed us to determine the cause and effect of this unique tree problem.

Through communication with other forest health professionals in the Great Plains and beyond, we learned this pattern of damage also had been seen in Nebraska, Colorado, Montana and Calgary, Alberta, Canada.

An insect geneticist from the USDA Agricultural Research Station in Fargo offered to genotype the wasps, and the analysis indicated that the wasps had a high likelihood of being from the genus Andricus. These wasps are not well understood and have very complex life cycles. Work continued to better understand the extent of this problem because it significantly limits the success rate of newly planted oak trees in North Dakota.

To assess the problem, eight neighborhoods were selected by the Fargo Forestry Department for survey, and tree placement records were prepared and shared with the assessors. The following neighborhoods were surveyed: Longfellow, Harwood Drive, Timberline, Hawthorne, South High School, Horace Mann, Oak Street and Bennett.

Figure 17: Oak trees, especially newer plantings, have been damaged by bark shredding as woodpeckers forage for numerous larvae and pupae of a tiny wasp species that overwinters in the bark in high densities. (*Aaron Bergdahl, NDFS*).

Boulevard trees from seven neighborhoods were assessed using the following methods: All boulevard oak trees in each neighborhood were inspected for damage characteristic of that seen with the phenomenon of interest. The diameter at breast height was measured using a standard diameter tape, and the height of each tree was measured using a telescopic height pole. The length of the leader also was measured using the height pole.

Damage to trees was rated on a scale of 1 to 4, with 0 = no damage, 1= 1 to 25 percent crown affected (limbs affected), 2 = 26 to 50 percent affected, 3 = 51 to 75 percent affected and 4 = 75 to 100 percent affected. Severe damage to major portions of the main stem constituted a damage rating of 4, even if little or no damage had occurred to branches.

Further, the height of the lowest and uppermost damage sites was measure and recorded. Gall severity also was rated visually as follows: 0 = no bullet galls, 1 = galls on one to two branches, 3 = galls on five or more branches and 4 = galls causing deformity/ dieback of branches. This was done to investigate whether gall severity was related to damage in some way.

Notes were taken to document anything notable about the tree. Such notes included descriptions of bark characteristics, presence of leaf/petiole galls, physical damage and presence of other insects.

A follow-up of severely damaged trees in the fall of 2014 revealed that the most severely infested and foraged trees did not recover.

Meyer Spruce Health Survey

Spruce needle cast diseases are a significant threat to spruce tree health in North Dakota, often having a significant negative effect on the aesthetics of landscape plantings and reduced function in conservation plantings and living snow fences. That is why Meyer spruce (*Picea meyeri*), a species native to China that is purported to be resistant to needle cast disease, was selected for a needle disease survey. (No formal evaluations of this resistance were found.)

Because Meyer spruce is available at Towner State Nursery, sales records were available and indicated where Meyer spruce plantings might be found. Additionally, Lundeby's Evergreens in Tolna, N.D., and Big Sioux Nursery in Watertown, S.D., also have a history of growing this tree species and gladly offered their assistance and allowed access to their plantings for evaluations. In all, 94 trees from five different sites were evaluated in 2014.

Meyer spruce is identified most easily by the cones (Figure 18A), although the mild pubescence on newer growth (Figure 18B) proved to be the most valuable characteristic for identification. Also, the growing form (Figure 18C) is somewhat useful for identification when paired with the other characteristics. Meyer spruce has been described as looking like (and feeling like, due to the sharper needles) a Colorado blue spruce but with the more upright growth form of a Black Hills spruce (as opposed to the more horizontal branch structure of the Colorado blue spruce).

Needles from the oldest persisting needle age class were sampled from the northern, southern, eastern and western portions of the lower crown. Average growth was recorded for the previous three years, and an overall evaluation of health, growth and form was conducted. In several cases, needle cast disease was verified on Colorado blue spruce and Black Hills spruce in the immediate area. Meyer spruce trees were evaluated in random increments at each site, depending on the size of the planting (every fifth or third, or every other tree in a row).

Figure 18: (top,) Twig and cone comparison of (left to right) Black Hills spruce, Colorado blue spruce and Meyer spruce; (middle) a close-up image of a Meyer spruce twig showing a light pubescence that is not seen on Black Hills or Colorado blue spruce; (bottom) a Black Hills spruce (left) and (right) a Meyer spruce tree. (*Aaron Bergdahl, NDFS*)

Overall growth of this species was noticed to be slow in the earlier years (the youngest evaluated plantings); however, accounts from Lundeby's Nursery and Big Sioux Nursery indicated that this was normal for the species prior to a growth spurt that eventually catches up to the average growth rate of other spruce species that grow in our region.

The slowest growing spruce were 7 years old and were growing about 3 inches per year in an establishing shelterbelt with weed barrier fabric and no irrigation in Rolette County N.D. The trees growing the best were in a nursery setting with tilled soil and no irrigation in Nelson County, N.D. An almost identical growth rate was measured from 7-year-old trees on a site in Ransom County, N.D., with drip irrigation and weed fabric. Trees in these sites had a three-year average growth of approximately 5.3 inches per year. On the Ransom County site, where at least 300 Meyer spruce were incorporated in a series of wildlife plantings, some trees had 2014 leaders in excess of 1 foot.

Some have questioned Meyer spruce's drought tolerance. At Big Sioux Nursery, a severe drought was experienced in 2012. The Meyer spruce that did not receive supplemental water suffered considerable dieback and reduced needle retention, while the Meyer spruce were not damaged in another area of the nursery where irrigation was provided. The trees that suffered drought grew about 1 inch less per year on average; however, the sample size was only 15 trees.

Needle cast fungi fruiting bodies were found on needles from several trees, and the spores were observed microscopically to verify whether the disease was Rhizosphaera needle cast, Stigmina needle cast or saprophytic fungi. Both needle cast fungi species were verified from samples; however, no fruiting bodies were found on needles less than 5 years old in any sampled trees. What was assumed to be saprophytic fungi, because the spores did not match Rhizosphaera or Stigmina, was observed growing on a few persisting dead needles from two samples and was thus not considered to be a threat to tree health.

The trees with the highest rate of needle cast fungi (Rhizosphaera) previously were severely drought-stressed trees that were within 40 feet of a row of Colorado blue spruce trees very severely infected with Rhizosphaera needle cast. At one site, fruiting bodies were found on 44 percent of the trees. Stigmina needle cast was confirmed on one tree, with the rest of the samples verified as Rhizosphaera needle cast. Fruiting bodies of Rhizosphaera needle cast were confirmed on 75 percent of the trees in the drought-stressed samples, compared with 15 percent on the nondrought-stressed trees at the same location but in a different area.

In conclusion, what is interesting is that in all cases, even the drought-stressed trees with a heavy inoculum load nearby, signs of needle cast were not found on any needles younger than 5 years old, and in most cases, needles were retained and disease-free for more than seven years. These preliminary observations from this initial effort may indicate a potential level of resistance to Rhizosphaera and Stigmina needle cast diseases, with subtle symptoms only shown in the oldest needle age classes of some trees. However, this information should not be considered as anything more than anecdotal at this stage.

This effort to evaluate needle cast disease resistance in Meyer spruce is in its very first stages, and assessments will expand and continue in coming years. Further, this assessment only focuses on a few parameters (growth and disease resistance), and several other factors must be considered when evaluating the suitability of Meyer spruce for planting in greater numbers in North Dakota.

North Dakota Spruce Health Survey

In 2014, Jim Walla of Northern Tree Specialties, a retired NDSU forest pathologist, was contracted to conduct a general health assessment of spruce plantings across North Dakota. The survey was designed as a resurvey of a long-term spruce health monitoring project started at NDSU in 1987. The most recent survey was conducted in 2006.

Spruce plantings were sampled along two east-west transects, one across southern North Dakota and one across northern North Dakota. Five counties distributed along each of those transects were selected, and between 10 and 15 plantings of various types were examined in each county. The counties were Cass, Stutsman, Burleigh, Stark and Golden Valley along the southern transect and Grand Forks, Ramsey, Pierce, Ward and Williams along the northern transect.

Examined plantings were selected in two ways. First, at least five spruce plantings at sites no closer than five miles from other sampled sites were selected in each county in a manner without known bias for the presence of specific needle diseases. Multiple planting types (e.g., single-row field windbreak, multi-row farmstead windbreak, wildlife habitat, urban park, cemetery plantings) were represented in the sample. Results of the study are expected in early 2015.

Section V

Aerial Forest Health Survey 2014

Aerial Survey Results Overview

In the summer of 2014, the NDFS conducted aerial surveys of forest resources in the Turtle Mountains (Appendix 1), the Souris (Mouse) River (Appendix 2), ponderosa pine forests in the southwestern region of North Dakota (Appendix 3), the Killdeer Mountains region (Appendix 4), riparian forests along the Missouri River (Appendix 5) and a portion of the Little Missouri River (Appendix 6).

The purpose of the survey was to identify forest health threats in the identified areas for later ground truthing. Ground truthing will serve to confirm the presence/absence of forest pests and provide management options to forestland owners/managers.

The NDFS Stewardship Program participated in the Turtle Mountains and Souris River portion of the survey to gain perspective on overmaturity of aspen resources in parts of the Turtle Mountains and riparian forest resources impacted by past flooding events.

The U.S. Forest Service's Forest Health Management Program Aerial Survey Team from Missoula, Mont., assisted in the survey of the ponderosa pine resources and Missouri River riparian forests in June.

For the July survey of the Turtle Mountains and Souris River, the Forest Health Program contracted with an aerial survey crew from the Minnesota Department of Natural Resources' Resource Assessment group from Grand Rapids, Minn. Both survey groups used geographical positioning systems on board the aircraft and aerial imagery on specialized tablet computers to record information about forest health.

The collected data was given to NDFS Forest Health for input into ArcMap, a geographical information system computer program enabling closer analysis, acreage calculations and mapping of forest health issues of concern. Aerial photos of areas of concern and healthy forests also were taken.

Figure 19: The general areas covered in the 2014 aerial surveys are highlighted in green.

Notable findings of the aerial survey include:

- Roughly 4,500 acres of forest tent caterpillar/large aspen tortrix defoliation occurred in the Turtle Mountains. This number is down from about 20,000 acres from the previous survey in 2011. Also, approximately 4,000 acres of aspen decline (undefined) was recorded in the Turtle Mountains. Overmaturity, meaning aspen stands are old and have accumulated various health problems such as stem and root rots, has been determined to be the main cause of this issue.
- In the Souris River basin, roughly 20,000 acres of standing dead trees were recorded due to flooding during the growing season (2011 flood).
- The state's only native ponderosa pine forests in Slope County comprise roughly 10,000 acres. Overall, these forests were in good health and no mountain pine beetle, an insect that has strongly impacted pine forests in the Black Hills, was observed. Damage to trees by porcupine feeding and other bark beetles was seen in several areas.
- Killdeer Mountain forest resources were overall in good health, although several defoliated areas were identified. These areas will be revisited in 2015 to determine the actual defoliator and determine the extent of the phenomenon.
- Forest resources along the Missouri River and Little Missouri River were in good health overall and no major forest health threats or trends were seen from the air.

Aerial surveying will continue in 2015 with a proposed focus on riparian forests on the Sheyenne River and Devils Lake Hills.

Section VI
Forest Health Program Events in 2014

Emerald Ash Borer First Detector Training

In 2014, Emerald ash borer (EAB) first detector training events again were held in Fargo and Mandan. More than 50 people attended the training, elevating the total number of North Dakota EAB first detectors to more than 300 since the program began in 2010.

Figure 20: Emerald Ash Borer First Detector Training at the Mandan, N.D., USDA Agricultural Research Station. (*Aaron Bergdahl, NDFS*)

Emerald Ash Borer Awareness Week

EAB Awareness Week 2014 was preceded by a governor's proclamation declaring May 19 to 25 to be a week to increase awareness of the potential threat of EAB to North Dakota's tree resources.

By partnering with the NDFS's Community Forestry Program, EAB Awareness Week took an important, large step forward in 2014. Utilizing Community Forestry's expertise and community contacts, the number of communities that participated doubled from the previous year to 32 towns of varying sizes across North Dakota. Several state parks also participated.

Weatherproof fliers were hung on ash trees to highlight information about EAB and its potential to alter tree resources drastically (Figure 21). Messages focused on issues such as the danger of transporting invasive tree pests such as EAB in firewood and increasing species diversity of community tree resources. Fact sheets and EAB talking points for use when addressing the news media also were provided to community contacts on flash drives (Figure 21).

Future EAB Awareness Week efforts will continue to involve cooperation among the NDFS, Forest Health and Community Forestry programs, the NDDA and NDSU Extension Forestry.

Figure 21: EAB Awareness Week fliers at a Bottineau, N.D., park and flash drives provided to cooperating communities. (*Aaron Bergdahl, NDFS*)

EAB Hands-on Field Experience Trip to Fort Snelling, Minn.

In April 2014, the NDFS sponsored the participation of 19 forestry professionals and Extension agents from four cities and five state and federal agencies across North Dakota in a field trip to an EAB infestation site at Fort Snelling, Minn.

Mark Abrahamson of the Minnesota Department of Agriculture and Val Cervenka of the Minnesota Department of Natural Resources hosted the group and facilitated a roundtable discussion. Rob Venette of the U.S. Forest Service, Northern Research Station, discussed EAB management experiences, considerations and cold hardiness. Several others having experience with EAB also shared their perspectives.

Later, participants were directed outside, given draw knives and allowed to peel the bark from trees in search of EAB larvae (Figure 22). Participants found larvae frequently. This activity provided participants with valuable first-hand experiences, as well as the experiences of people who deal with EAB issues on a regular basis.

Figure 22: (top) Dead EAB larvae that froze during their overwintering period under the bark; (bottom) participants from the NDFS and NDSU Extension closely examine and take photographs of EAB larvae revealed by careful bark peeling. (*Aaron Bergdahl, NDFS*)

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Appendix

Appendix 1: Native, predominantly aspen forests in the Turtle Mountains of north-central North Dakota experienced relatively little pressure from defoliating insects in 2014, compared with 2013. (*Aaron Bergdahl, NDFS*)

Appendix 2: Dead, mature trees still standing in the Souris River basin in north-central North Dakota due to long-duration flooding in 2011. (*Aaron Bergdahl, NDFS*)

Appendix 3: Ponderosa pine forests in the southwestern region of North Dakota.
(*Aaron Bergdahl, NDFS*)

Appendix 4: Forested areas of the Killdeer Mountains in Dunn County. N.D., showing evidence of defoliation by a yet unidentified defoliating agent. (*Aaron Bergdahl, NDFS*)

Appendix 5: Riparian forests along the Missouri River were generally in excellent health, although concerns about limited cottonwood regeneration remain. (*Aaron Bergdahl, NDFS*)

Appendix 6: The riparian forests on the banks of the Little Missouri River. (*Aaron Bergdahl, NDFS*)

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